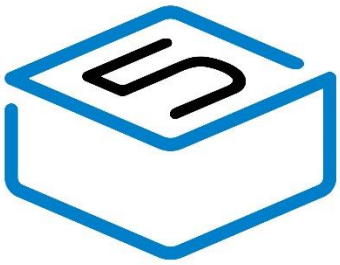

M5STACK

Unit CardKB2 User Manual

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The Unit CardKB2 is a portable matrix keyboard module that supports multiple communication methods and can be connected to the host device via I2C, UART, Bluetooth HID, ESP-NOW, etc.

I. Operating Instructions

1 Special function keys

(1) **Aa key** : Caps Lock key

The capitalization key is used to control the case status of letter input. Its operation methods are as follows:

- Single click: Enable one-time capitalization. After inputting a character, it automatically switches back to lowercase.
- Double click: Enable capital lock. Double-click or single-click again to release the lock and restore to lowercase.
- Hold: During the press, maintain capital output. Release to restore to lowercase.

When the capitalization function is enabled, **the green indicator light comes on**; when it is disabled, the light goes off.

(2) **Sym key** : Symbol key

The symbol key is used to set the symbol mode. After clicking the symbol key, **the blue indicator light will light up**, indicating that symbol mode is enabled. Click it again to exit symbol mode.

(3) **Fn key** : Function key

The function keys are used for mode switching and to execute combined functions. When the function keys are pressed, **the red indicator light comes on**. The supported function combinations are as follows:

Table 1 Fn Function Combination Keys Table

Combination Keys	Function
Fn + 1	Esc
Fn + D	Move the cursor up (↑)
Fn + X	Move the cursor down (↓)
Fn + Z	Move the cursor left (←)
Fn + C	Move the cursor right (→)

2 Mode switch (Fn + Sym + Number Key)

The keyboard's working mode can be switched by using the combination keys. After the switch, the settings will be automatically saved and will remain in the new mode when the device is powered on next time.

Table 2 Mode Switch Combination Key Table

Combination Keys	Mode	LED Feedback
Fn + Sym + 1	I2C mode (factory default)	White LED flashes once
Fn + Sym + 2	UART mode	White LED flashes twice
Fn + Sym + 3	ESP-NOW broadcast mode	White LED flashes three times
Fn + Sym + 4	BLE HID mode	White LED flashes four times

3 Key retention feature

When the button is held down (for more than 300ms), it will continuously output, with a repeat output interval of 50ms (approximately 20 times per second).

4 USB serial port output

In all modes , the button values will be output via USB serial port.

(1) Serial port baud rate: 115200

(2) Key output information format: "KEY [KEY_ID] [KEY_STATE]"

- **KEY_ID** : Key index (0-43)
  - Key index = row number × 11 + column number
  - Row number range: 0-3, column number range: 0-10
- **KEY_STATE** : Key status
  - PRESS
  - RELEASE

II. Key Code Mapping Table

The key code mapping table describes the ASCII code value corresponding to each key on the keyboard in different input modes. When a key is pressed, the device outputs the corresponding ASCII code value via I2C, and the application can identify the key pressed by the user based on these ASCII code values .

Table 3 Normal Mode Key Code Mapping Table

Line 1	**Key**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	
	Value	0x31	0x32	0x33	0x34	0x35	0x36	0x37	0x38	0x39	0x30	
Line2	**Key**	**q**	**w**	**e**	**r**	**t**	**y**	**u**	**i**	**o**	**p**	**Delete**
	Value	0x71	0x77	0x65	0x72	0x74	0x79	0x75	0x69	0x6F	0x70	0x08
Line3	**Key**	**Aa**	**a**	**s**	**d**	**f**	**g**	**h**	**j**	**k**	**l**	**Enter**
	Value		0x61	0x73	0x64	0x66	0x67	0x68	0x6A	0x6B	0x6C	0x0A
Line4	**Key**	**Fn**	**Sym**	**z**	**x**	**c**	**v**	**b**	**n**	**m**	**Space**	
	Value			0x7A	0x78	0x63	0x76	0x62	0x6E	0x6D	0x20	

Table 4 Caps Lock Key Code Mapping Table

Line 1	**Key**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	
	Value	0x31	0x32	0x33	0x34	0x35	0x36	0x37	0x38	0x39	0x30	
Line 2	**Key**	**Q**	**W**	**E**	**R**	**T**	**Y**	**U**	**I**	**O**	**P**	**Delete**
	Value	0x51	0x57	0x45	0x52	0x54	0x59	0x55	0x49	0x4F	0x50	0x08
Line3	**Key**	**Aa**	**A**	**S**	**D**	**F**	**G**	**H**	**J**	**K**	**L**	**Enter**
	Value		0x41	0x53	0x44	0x46	0x47	0x48	0x4A	0x4B	0x4C	0x0A
Line 4	**Key**	**Fn**	**Sym**	**Z**	**X**	**C**	**V**	**B**	**N**	**M**	**Space**	
	Value			0x5A	0x58	0x43	0x56	0x42	0x4E	0x4D	0x20	

Table 5 Symbolic Mode Key Code Mapping Table

Line 1	**Key**	**!**	**@**	**#**	**$**	**%**	**^**	**&**	*****	**(**	**)**	
	Value	0x21	0x40	0x23	0x24	0x25	0x5E	0x26	0x2A	0x28	0x29	
Line2	**Key**	**~**	**`**	**?**	****	**/**	**|**	**_**	**-**	**+**	**=**	**Delete**
	Value	0x7E	0x60	0x3F	0x5C	0x2F	0x7C	0x5F	0x2D	0x2B	0x3D	0x08
Line3	**Key**	**Aa**	**{**	**}**	**^**	**[**	**]**	**"**	**'**	**;**	**:**	**Enter**
	Value		0x7B	0x7D	0x5E	0x5B	0x5D	0x22	0x27	0x3B	0x3A	0x0A
Line 4	**Key**	**Fn**	**Sym**	**Z**	**X**	**C**	**<**	**>**	**,**	**.**	**Space**	
	Value			0x5A	0x58	0x43	0x3C	0x3E	0x2C	0x2E	0x20	

Note: 1. Blank indicates that the key value will not be output.

2. After pressing the Sym key, the symbol mode is entered. At this point, the Aa key becomes ineffective.

III. I2C Mode

I2C mode is **the default mode upon power-on** , and communication is via the GROVE port.

1 Keypad data register

Reads 1 byte of data directly via I2C and returns the ASCII code value corresponding to the pressed key.

- Communication parameters:
  - Communication address: 0x5F
  - Communication rate: 100kHz
- Return:
  - Key pressed: Returns the ASCII code value of the corresponding key (refer to the key code mapping table)
  - No key pressed: Returns `0x00`

2 Firmware version register

Reads the firmware version information directly via I2C.

- Communication parameters:
  - Communication address: 0xF1
  - Communication rate: 100kHz
- Return: Firmware version

IV. UART Mode

UART mode, communicating via the GROVE port .

- Communication parameters: 115200-8N-1
- Data frame format: AA [DATA_LEN] [KEY_ID] [KEY_STATE] checksum
  - **DATA_LEN** : Data length, fixed at 0x03
  - **KEY_ID** : Key index (0-43)

    Key index = row number × 11 + column number, where row number range: 0-3, column number range: 0-10
  - **STATE** : Button state, 0x01 -- pressed, 0x02 -- released
  - **Checksum** : The verification sum is calculated as follows: `checksum = (DATA_LEN + KEY_ID + KEY_STATE) & 0xFF`

  Example:

  Press button "1" (index 0): Send data packet `0xAA 0x03 0x00 0x01 0x04`

  Release button "1" (index 0): Send data packet `0xAA 0x03 0x00 0x02 0x05`

V. ESP-NOW Mode

After switching to ESP-NOW mode, button events will be broadcast to nearby ESP32 devices via the ESP-NOW protocol.

- Communication parameters
  - **Protocol** : ESP-NOW (based on WiFi 2.4GHz)
  - **WiFi mode** : Station (STA) mode
  - **Broadcast address** : `0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF` (broadcasts all 0xFF)
  - **Channel** : Channel 0
- Data frame format: Same as UART mode

VI. BLE HID Mode

Switching to Bluetooth HID mode allows it to connect to Bluetooth-enabled devices as a wireless keyboard.

- Usage steps:

  1. Press Fn + Sym + 4 to switch to Bluetooth HID mode;

  2. Search for Bluetooth devices on your phone/tablet/computer. Device name: CardKB2-xxxx (" xxxx " represents the last four digits of the MAC address);

  3. Once paired and connected, it can be used as a wireless keyboard.